AVT Prosilica GS

Technical Manual

AVT GigE Vision Cameras

V2.0.5

26 November 2013

Allied Vision Technologies GmbH
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ALLIED Vision Technologies

Legal notice

For customers in the U.S.A.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interferences will not occur in a particular installation. If the equipment does cause harmful interference to radio or television reception, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the distance between the equipment and the receiver.
- Use a different line outlet for the receiver.
- Consult a radio or TV technician for help.

You are cautioned that any changes or modifications not expressly approved in this manual could void your authority to operate this equipment. The shielded interface cable recommended in this manual must be used with this equipment in order to comply with the limits for a computing device pursuant to Subpart A of Part 15 of FCC Rules.

For customers in Canada

This apparatus complies with the Class A limits for radio noise emissions set out in the Radio Interference Regulations.

Pour utilisateurs au Canada

Cet appareil est conforme aux normes classe A pour bruits radioélectriques, spécifiées dans le Règlement sur le brouillage radioélectrique.

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Contents

Contacting Allied Vision Technologies 5

Introduction 6

Document history 6
Conventions used in this manual 7
Styles 7
Symbols 7
Precautions 8
Cleaning optics 9
Identifying debris 9
Locating debris 9
Color cameras with IR filter 9
Cleaning with air 10
Contact cleaning 10

Conformity 11

Specifications 12

Prosilica GS650/650C 12
Prosilica GS660/660C 14
Prosilica GS1380/1380C 16
Prosilica GS2450/2450C 18

Camera attribute highlights 20

Filters 21

Camera dimensions 22

Mechanical drawings 23

Landscape sensor 23
Portrait sensor 24
Optical flange focal distance 25
Adjustment of lens mount 26
Loosen locking ring 26
Image to infinity 26

Camera interfaces 27

Status LEDs 27
Gigabit Ethernet port 28
Camera I/O connector pin assignment 29
I/O definition 30
Camera power 30

Isolated IO ground 30
RxD RS-232 and TxD RS-232 30
Input triggers 30
Output signals 31
Signal ground 32
Video iris 32
Reserved 32
Camera I/O opto-isolated user circuit example 33
Camera I/O non-isolated user circuit example 34
Video iris user circuit example 35
Trigger timing diagram 36
Notes on triggering 36
Firmware update 38
Resolution and ROI frame rates 39
Prosilica GS650 39
Prosilica GS660 40
Prosilica GS1380 40
Prosilica GS2450 41
Prosilica GS model comparison 41
Description of the data path 42
Prosilica GS: monochrome cameras 42
Prosilica GS: color cameras 42
Additional references 43
Index 44

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Introduction

This **AVT Prosilica GS Technical Manual** describes in depth the technical specifications of the Prosilica GS camera family including dimensions, feature overview, I/O definition, trigger timing waveforms, and frame rate performance.

For information on software installation read the **AVT GigE Installation Manual.** For detailed information on camera features and controls specific to the Prosilica GS refer to the **AVT GigE Camera and Driver Features** and **AVT GigE Camera and Driver Attributes** documents.

www

AVT Prosilica GS literature:
http://www.alliedvisiontec.com/us/support/downloads/product-literature/prosilica-gs.html

Document history

Version	Date	Remarks
V2.0.0	2011-Jul-14	New Manual - SERIAL status
V2.0.1	2013-Jan-28	• Renamed Camera IO signals • Reworked cleaning optics section • Reworked the spectral plots and Frame rate vs.Height graphs • Removed the internal I/O circuit diagram
V2.0.2	2013-Apr-22	• Updated the RoHS directive • Updated the exposure control values in the *Specifications* chapter • Added the *Status LEDs* section • Updated the pixel format naming according to the GenICam naming convention • Added frame rate formulas in the *Resolution and ROI frame rates* chapter • Added VIMBA SDK link in *Additional references* section • Updated AVT recommended cabling to Category 6 or higher in the *Gigabit Ethernet port* section
V2.0.3	2013-Jul-05	• Added contact information for Allied Vision Technologies (Shanghai) Co. Ltd. • Updated the links to **AVT GigE Installation Manual** • Added links to **AVT GigE Camera and Driver Features** document
to be continued on next page		

Table 1: Document history

Version	Date	Remarks
		continued from last page
V2.0.4	2013-Oct-02	• Added optical flange focal distance and maximum lens protrusion information on page 25 • Updated *Cleaning optics* section • Updated **vertical binning** value for *Prosilica GS660/660C* • Updated table 7 on page 20 • Updated links to AVT PvAPI SDK
V2.0.5	2013-Nov-26	• Added chapter *Description of the data path* on page 42 • Updated Index

Table 1: Document history

Conventions used in this manual

To give this manual an easily understood layout and to emphasize important information, the following typographical styles and symbols are used:

Styles

Style	Function	Example
Bold	Programs, inputs, or highlighting important information	**bold**
Courier	Code listings etc.	Input
Upper case	Register	REGISTER
Italics	Modes, fields	*Mode*
Parentheses and/or blue	Links	(Link)

Table 2: Styles

Symbols

Note This symbol highlights important information.

Caution

This symbol highlights important instructions. You have to follow these instructions to avoid malfunctions.

www

This symbol highlights URLs for further information. The URL itself is shown in blue.

Example:

http://www.alliedvisiontec.com

Precautions

Caution

Do not disassemble the camera housing. Warranty is void if camera has been disassembled.

This camera contains sensitive internal components.

Caution

Keep shipping material.

Poor packaging of the product may cause damage during shipping.

Caution

Verify all external connections.

Verify all external connections in terms of voltage levels, power requirements, voltage polarity, and signal integrity prior to powering the device.

Caution

Cleaning.

This product can be damaged by some volatile cleaning agents. Avoid cleaning the image sensor unless absolutely necessary. Please see instructions on optics cleaning in this document.

Caution

Do not exceed environmental specifications.

See environmental specifications limits in the Specifications section of this document. Special care must be taken to maintain a reasonable operating temperature. If the camera is operated in temperatures higher than the specified range, the camera should be mounted on a heat sink.

Cleaning optics

Caution

AVT does not warranty against any physical damage to the sensor/filter/protection glass or lenses. **Use utmost care when cleaning optical components**.

Caution

Do not touch any optics with fingers. Oil from fingers can damage fragile optical coatings.

Identifying debris

Debris on the image sensor or optical components appears as a darkened area or smudge on a camera image. Do not confuse this with a pixel defect which appears as a distinct point.

Locating debris

First determine whether the debris is on the sensor glass, IR filter (if used), or lens. The farther away the debris is from the sensor, the blurrier the debris appears on a camera image.

Stream a live image from the camera using a uniform target, such as a piece of paper. To determine if the debris is on the camera lens, rotate the lens independent of the camera. If the spot moves, the debris is on the lens. Otherwise, the debris is on the IR filter (if used) or sensor glass.

Color cameras with IR filter

Prosilica GS color cameras are equipped with an IR filter. With no lens or lens cap on a camera, the IR filter is exposed and debris can accumulate on it. This is the most probable location for debris. It should not be necessary to remove the IR filter for cleaning. Clean the outside of the IR filter glass using the techniques explained in the next section.

If it is determined that the debris is on the inside surface of the filter glass, or on the sensor glass, IR filter removal is necessary. Depending on the manufacturing date of your Prosilica GS camera, the IR filter may be slot type, or pinhole type. Slot type filters can be removed using a small flat head screw driver. Pinhole type filters require a pin spanner wrench for removal.

Note

A pin spanner wrench suitable for IR filter removal is available for purchase from AVT.
AVT P/N: E9020001

Cleaning with air

Blow directly on the contaminated surface with moderate pressure, clean compressed air.

Caution

Do not exceed 6 bar (90 psi). If using canned air, approximately ~ 4.8 bar (70 psi) when full, do not shake or tilt the can, as extreme changes in temperature due to sudden cold air can crack the optic glass.

View a live image with the camera after blowing. If debris is still present, repeat the process until it is determined that the particulate cannot be dislodged. If this is the case, proceed to the contact cleaning technique.

Contact cleaning

Only use this method if the above air cleaning method does not sufficiently clean the surface. Use 99% pure isopropyl alcohol and clean cotton swabs. Wet the swab in the alcohol. Quickly wipe the optics in a single stroke. Prolonged exposure of alcohol on the swab can cause the swab glue to loosen and transfer to the optic glass. Do not reuse the same swab. Repeat this process until the debris is removed. If this process fails to remove the debris, contact AVT.

Conformity

Allied Vision Technologies declares under its sole responsibility that all standard cameras of the **AVT Prosilica GS** family to which this declaration relates are in conformity with the following standard(s) or other normative document(s):

- CE, following the provisions of 2004/108/EG directive
- FCC Part 15 Class A
- RoHS (2011/65/EU)

CE

We declare, under our sole responsibility, that the previously described **AVT Prosilica GS** cameras conform to the directives of the CE.

FC

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential environment. This equipment generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. Any modifications not expressly approved in this manual may void your authority to operate this equipment.

Specifications

Prosilica GS650/650C

Feature	Specification
Resolution	659 x 493
Sensor	Sony ICX424
Type	CCD Progressive
Sensor size	Type 1/3
Cell size	7.4 µm
Lens mount	C (adjustable) / CS
Max frame rate at full resolution	120 fps
A/D	14 bit
On-board FIFO	16 MB
Bit depth	8/12
Mono formats	GS650: Mono8, Mono12, Mono12Packed; GS650C: Mono8
Color formats	BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed
Exposure control	10 µs to 78.5 s; 1 µs increments
Gain control	0 to 30 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to 14 rows
TTL I/Os	1 input, 1 output
Opto-coupled I/Os	1 input, 1 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-22XX**A**; 5–25 VDC: Cameras SN: 02-22XX**B**
Power consumption	3 W
Mass	59 g
Dimensions	51 x 89 mm (board size - W x L)
Sensor orientations	Landscape, portrait
Connector orientations	Inline, vertical
Operating temperature	0 to +70 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	1.0 µs for non-isolated I/O, 9 µs for isolated I/O
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O
Tpd	10 ns for non-isolated I/O, 1.3 µs for isolated I/O
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 3: Prosilica GS650/650C camera specifications

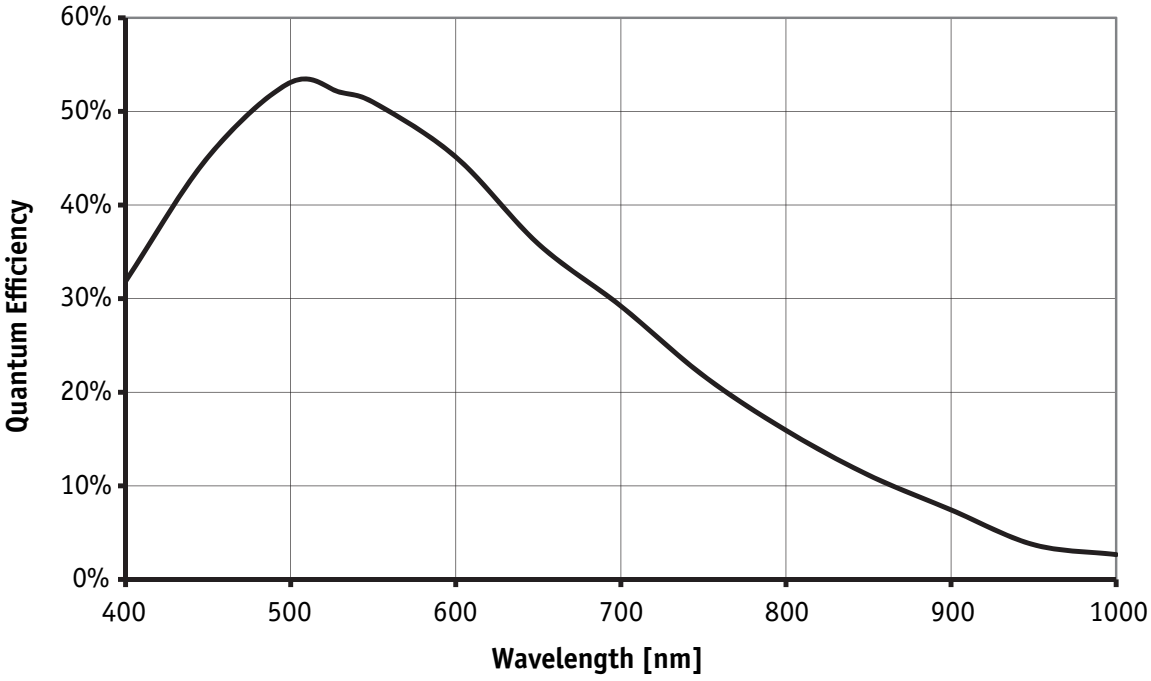


Figure 1: Prosilica GS650 monochrome spectral response

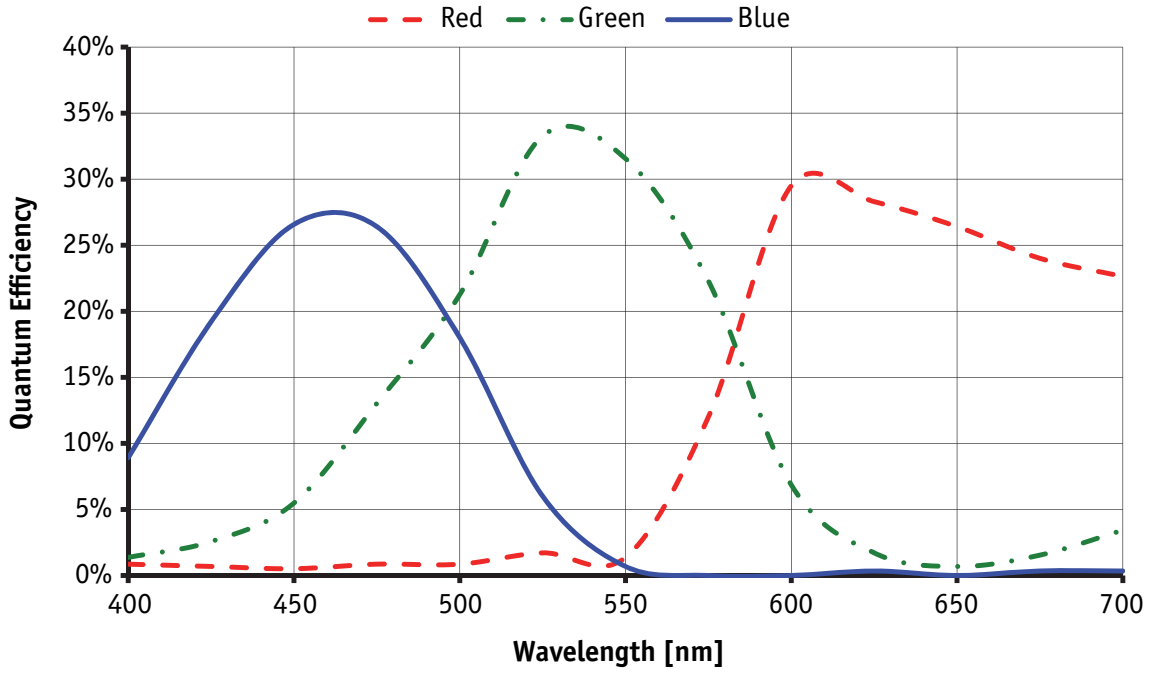


Figure 2: Prosilica GS650C color spectral response (without IR cut filter)

Prosilica GS660/660C

Feature	Specification
Resolution	659 x 493
Sensor	Sony ICX618
Type	CCD Progressive
Sensor size	Type 1/4
Cell size	5.6 µm
Lens mount	C (adjustable) /CS
Max frame rate at full resolution	119 fps
A/D	14 bit
On-board FIFO	16 MB
Bit depth	8/12
Mono formats	GS660: Mono8, Mono12, Mono12Packed GS660C: Mono8
Color formats	BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed
Exposure control	10 µs to 78.5 s; 1 µs increments
Gain control	0 to 30 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to 14 rows
TTL I/Os	1 input, 1 output
Opto-coupled I/Os	1 input, 1 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-22XX**A** 5–25 VDC: Cameras SN: 02-22XX**B**
Power consumption	3 W
Mass	59 g
Dimensions	51 x 89 mm (board size - W x L)
Sensor orientations	Landscape
Operating temperature	0 to +70 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	2 µs for non-isolated I/O, 10 µs for isolated I/O
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O
Tpd	10 ns for non-isolated I/O, 1.3 µs for isolated I/O
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 4: Prosilica GS660/660C camera specifications

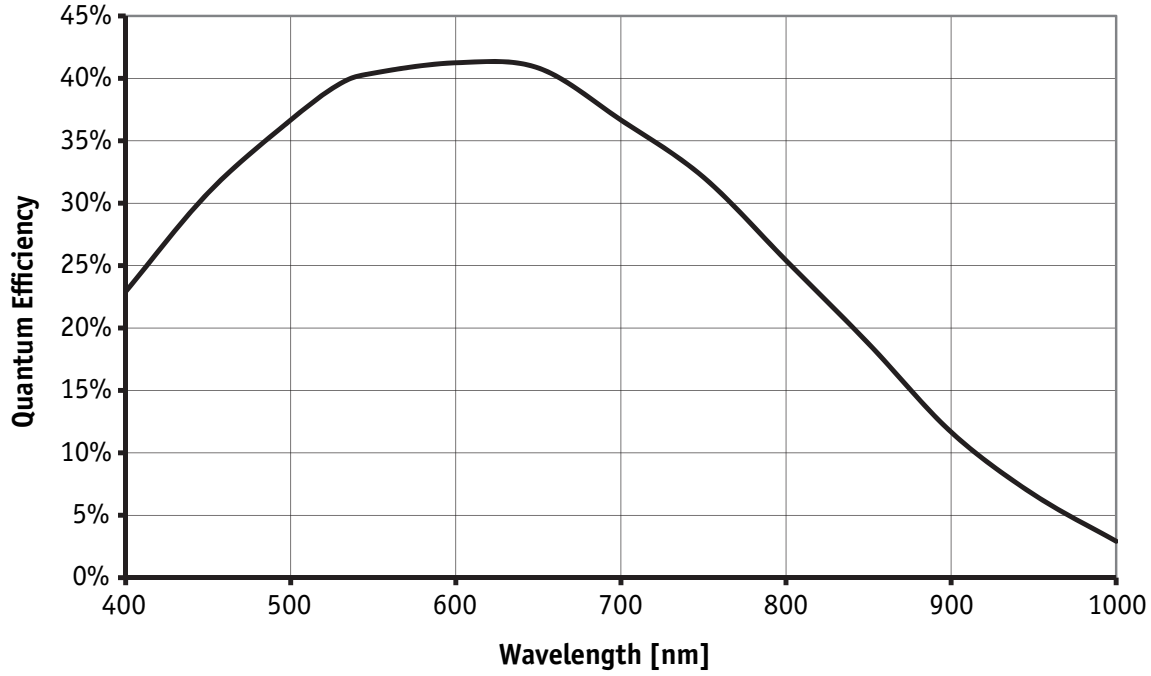


Figure 3: Prosilica GS660 monochrome spectral response

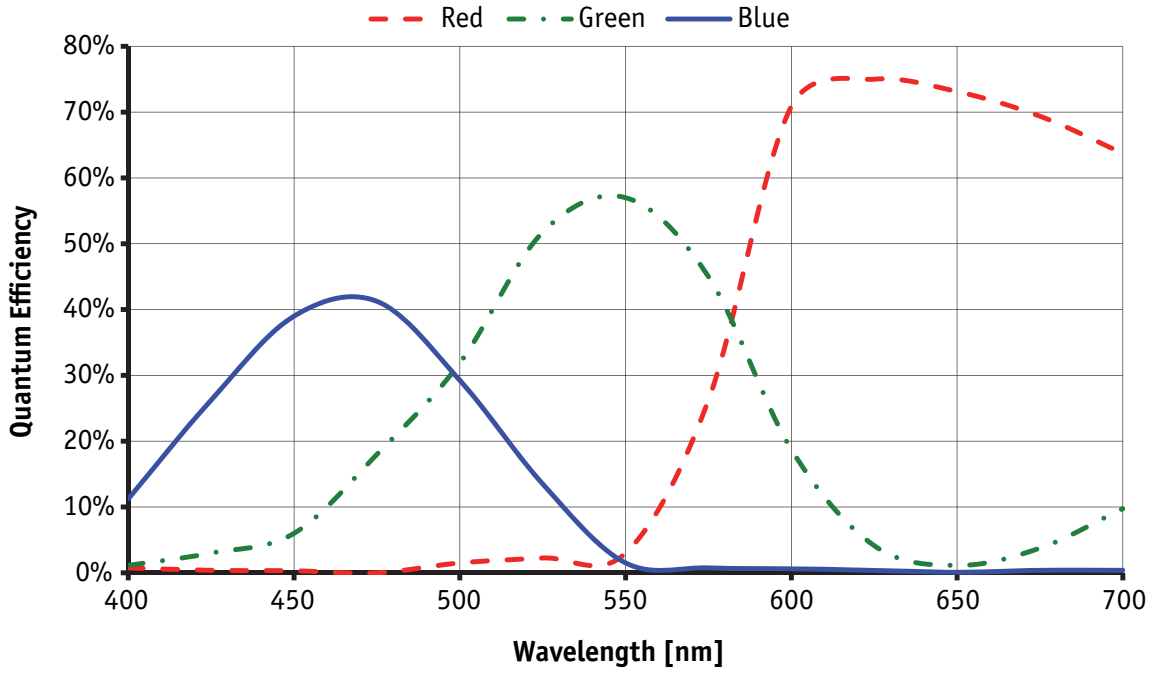


Figure 4: Prosilica GS660C color spectral response (without IR cut filter)

Prosilica GS1380/1380C

Feature	Specification
Resolution	1360 x 1024
Sensor	Sony ICX285AL CCD (ICX285AQ for color)
Type	CCD Progressive
Sensor size	Type 2/3
Cell size	6.45 µm
Lens mount	C (adjustable) / CS
Max frame rate at full resolution	30 fps
A/D	14 bit
On-board FIFO	16 MB
Bit depth	8/12
Mono formats	GS1380: Mono8, Mono12, Mono12Packed GS1380C: Mono8
Color formats	BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed
Exposure control	10 µs to 78.5 s; 1 µs increments
Gain control	0 to 30 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to 14 rows
TTL I/Os	1 input, 1 output
Opto-coupled I/Os	1 input, 1 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-22XX**A** 5–25 VDC: Cameras SN: 02-22XX**B**
Power consumption	3 W
Mass	54 g
Dimensions	51 x 89 mm (board size - W x L)
Sensor orientations	Landscape, portrait
Operating temperature	0 to +70 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	1 µs for non-isolated I/O, 9 µs for isolated I/O
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O
Tpd	10 ns for non-isolated I/O, 1.3 µs for isolated I/O
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 5: Prosilica GS1380/1380C camera specifications

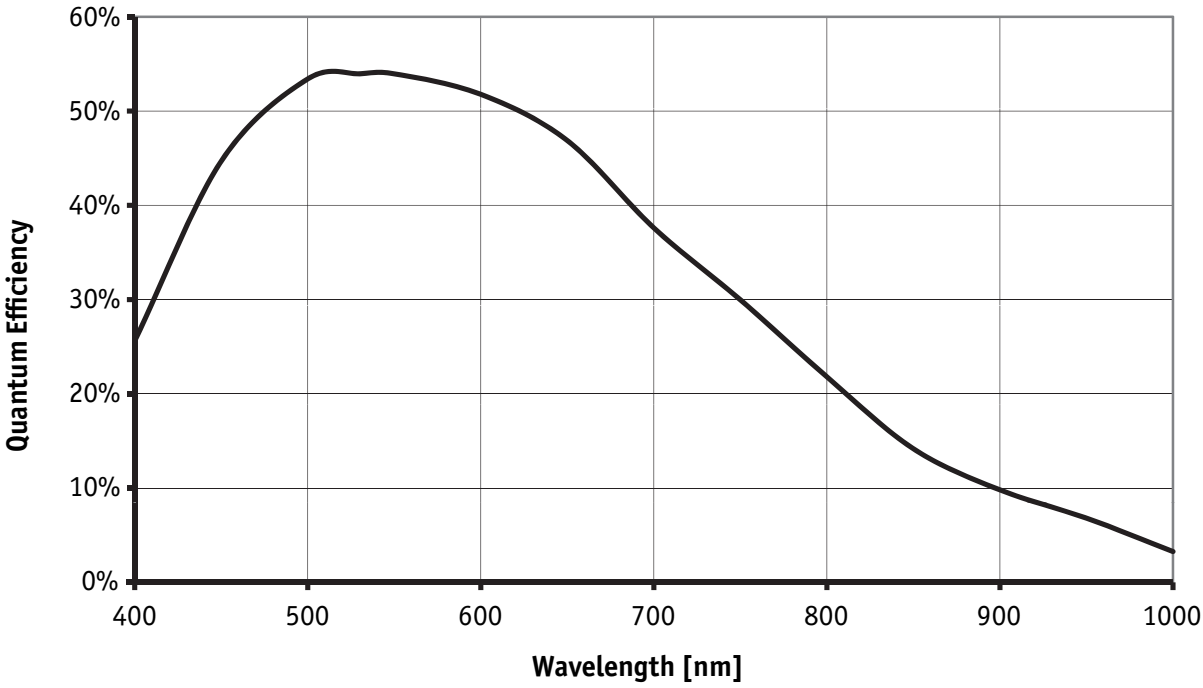


Figure 5: Prosilica GS1380 monochrome spectral response

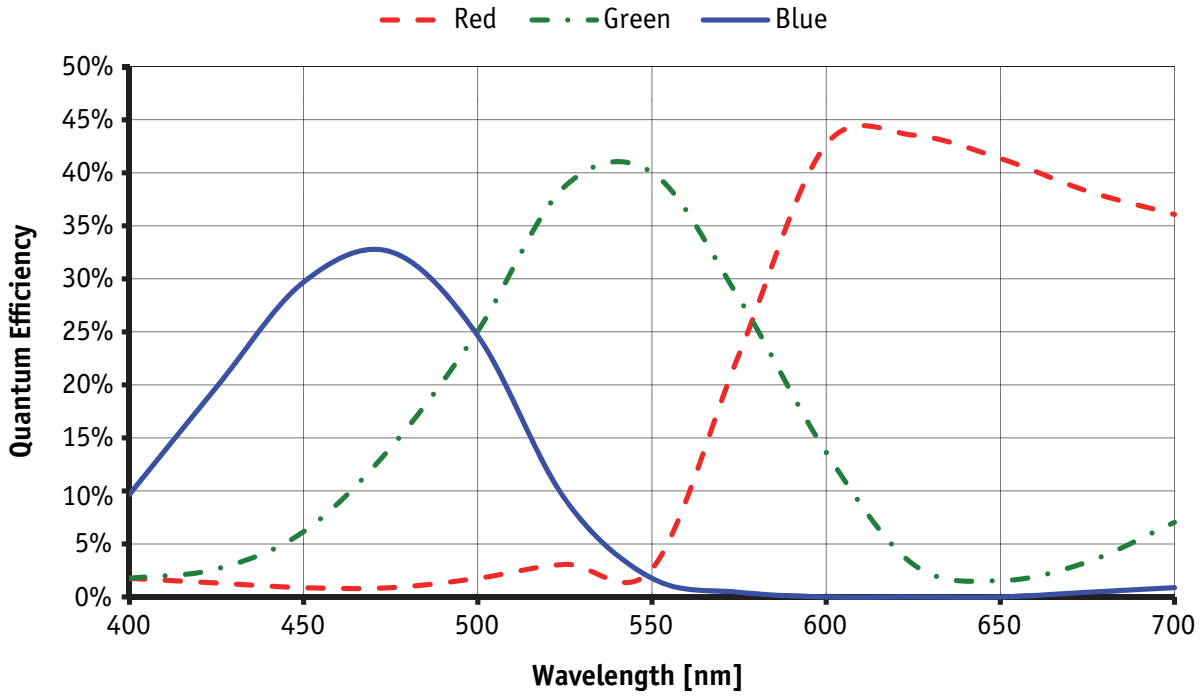


Figure 6: Prosilica GS1380C color spectral response (without IR cut filter)

Prosilica GS2450/2450C

Feature	Specification
Resolution	2448 x 2050
Sensor	Sony ICX625
Type	CCD Progressive
Sensor size	Type 2/3
Cell size	3.45 µm
Lens mount	C (adjustable) / CS
Max frame rate at full resolution	15 fps
A/D	14 bit
On-board FIFO	16 MB
Bit depth	8/12
Mono formats	GS2450: Mono8, Mono12, Mono12Packed GS2450C: Mono8
Color formats	BayerRG8, BayerRG12, BayerGR12Packed, RGB8Packed, BGR8Packed, YUV411Packed, YUV422Packed, YUV444Packed
Exposure control	10 µs to 42.9 s; 1 µs increments
Gain control	0 to 30 dB
Horizontal binning	1 to 8 pixels
Vertical binning	1 to 14 rows
TTL I/Os	1 input, 1 output
Opto-coupled I/Os	1 input, 1 output
RS-232	1
Power requirements	5–16 VDC: Cameras SN: 02-22XX**A** 5–25 VDC: Cameras SN: 02-22XX**B**
Power consumption	3 W
Mass	54 g
Dimensions	51 x 89 mm (board size - W x L)
Sensor orientations	Landscape
Operating temperature	0 to +70 °C ambient temperature (without condensation)
Storage temperature	-10 to +70 °C ambient temperature (without condensation)
Trigger latency	2 µs for non-isolated I/O, 10 µs for isolated I/O
Trigger jitter	±20 ns for non-isolated I/O, ±0.5 µs for isolated I/O
Tpd	10 ns for non-isolated I/O, 1.3 µs for isolated I/O
Operating humidity	20 to 80% non-condensing
Hardware interface standard	IEEE 802.3 1000BASE-T, 100BASE-TX
Software interface standard	GigE Vision Standard 1.2
Regulatory	CE, FCC Class A, RoHS (2011/65/EU)

Table 6: Prosilica GS2450/2450C camera specifications

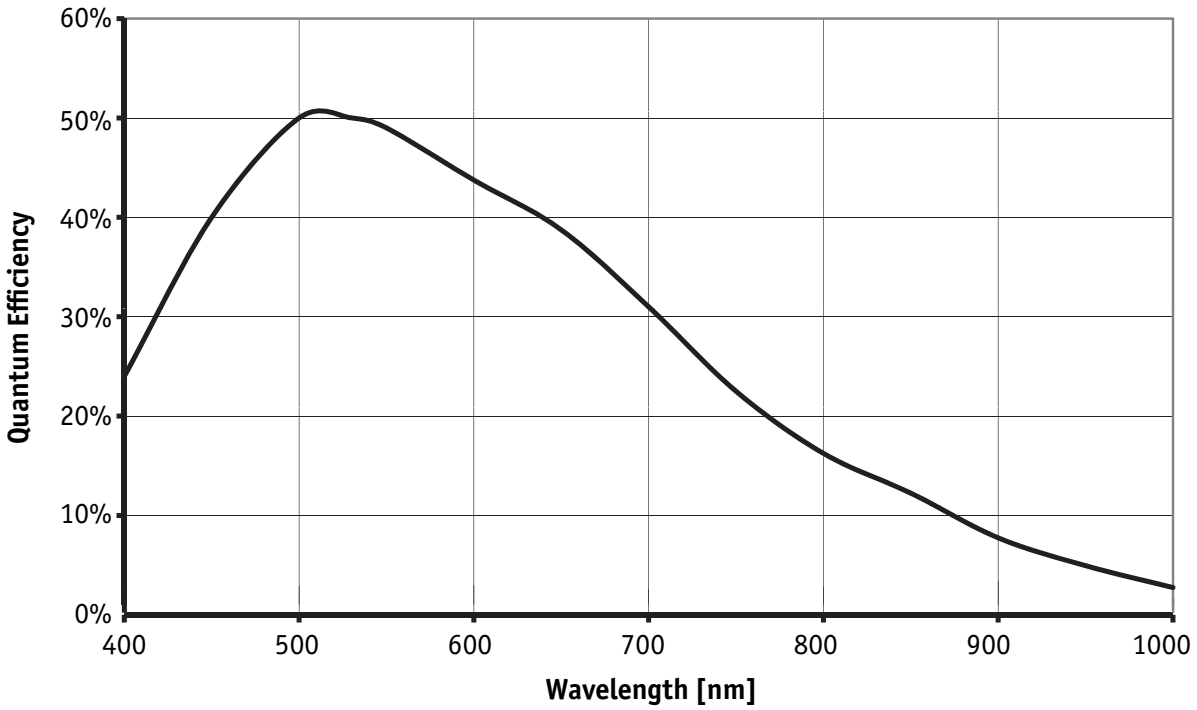


Figure 7: Prosilica GS2450 monochrome spectral response

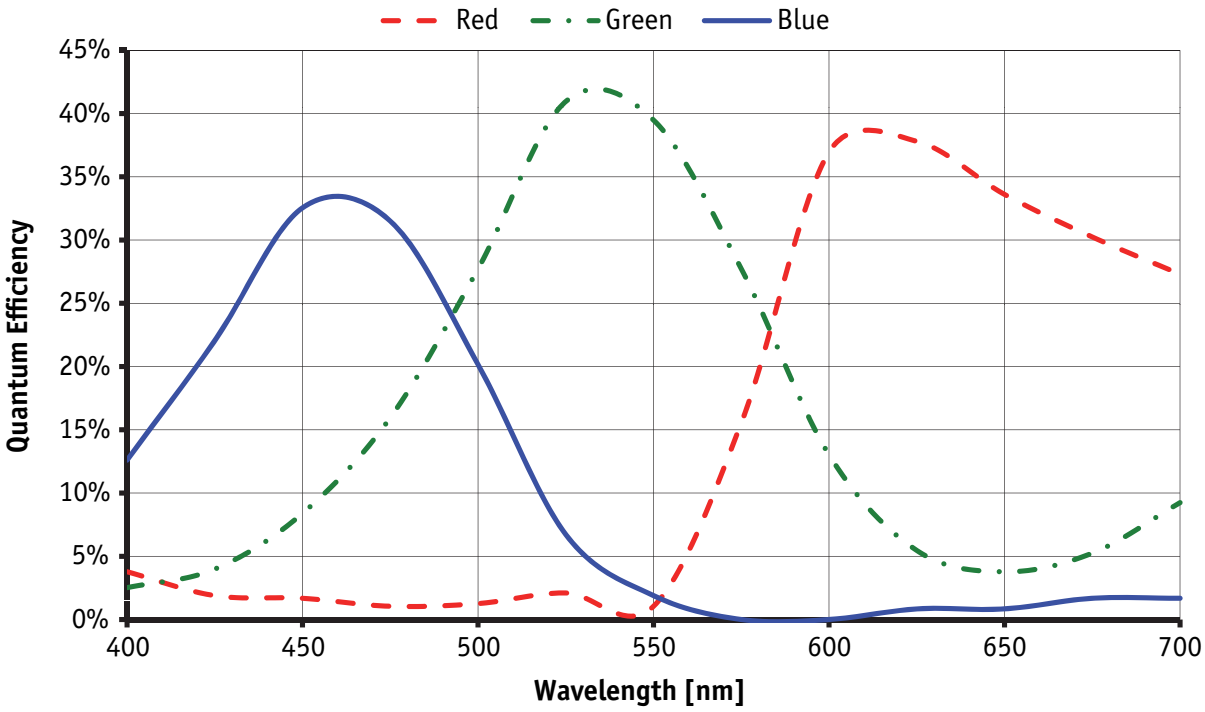


Figure 8: Prosilica GS2450C color spectral response (without IR cut filter)

Camera attribute highlights

AVT cameras support a number of standard and extended features. The table below identifies a selection of interesting capabilities of the Prosilica GS camera family.

www

A complete listing of camera controls, including control definitions can be found online:

PvAPI users: AVT GigE Camera and Driver Attributes document

VIMBA users: AVT GigE Camera and Driver Features document

Control	Description
Gain control	Manual and auto
Exposure control	Manual and auto
White balance	Red and blue channel; manual and auto control
External trigger event	Rising edge, falling edge, any edge, level high, level low
External trigger delay	0 to 60* s; 1 µs increments
Fixed rate control	0.001 fps to maximum frame rate
Imaging modes	Free-running, external trigger, fixed rate, software trigger
Sync out modes	Trigger ready, trigger input, exposing, readout, imaging, strobe, GPO
Region of interest	Independent x and y control with 1 pixel resolution
Multicast	Streaming to multiple computers
Event channel	In-camera events including exposure start and trigger are asynchronously broadcasted to the host computer
*May vary depending on the camera model	

Table 7: Prosilica GS camera and driver attribute highlights

Filters

All Prosilica GS color models are equipped with an infrared block filter (IR filter). This filter is employed to prevent infrared wavelength photons from passing to the sensor. In the absence of IR filter, images are dominated by red and incapable of being properly color balanced. Monochrome cameras do not employ an IR filter.

The figure below shows the filter transmission response for the IRC30 filter employed in the Prosilica GS cameras.

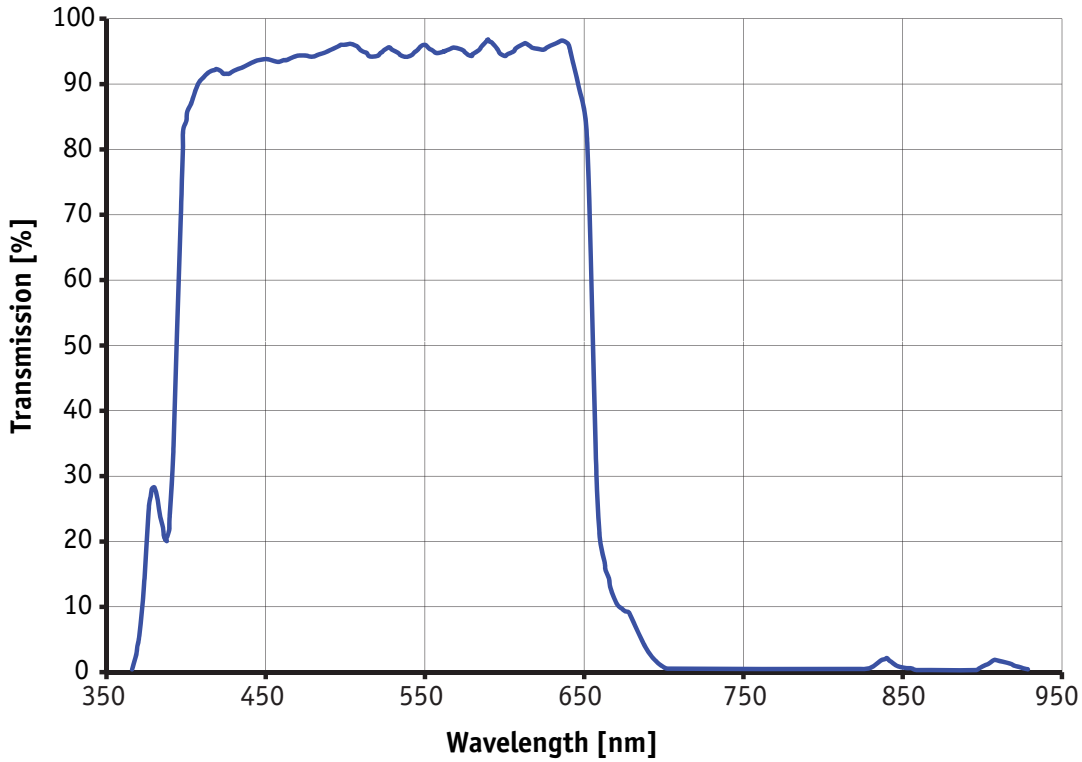


Figure 9: IRC30 filter transmission response

Camera dimensions

The **Prosilica GS** camera family offers several sensor orientation options. The camera variations are described below and detailed dimension drawings are provided in Mechanical drawings in the next section.

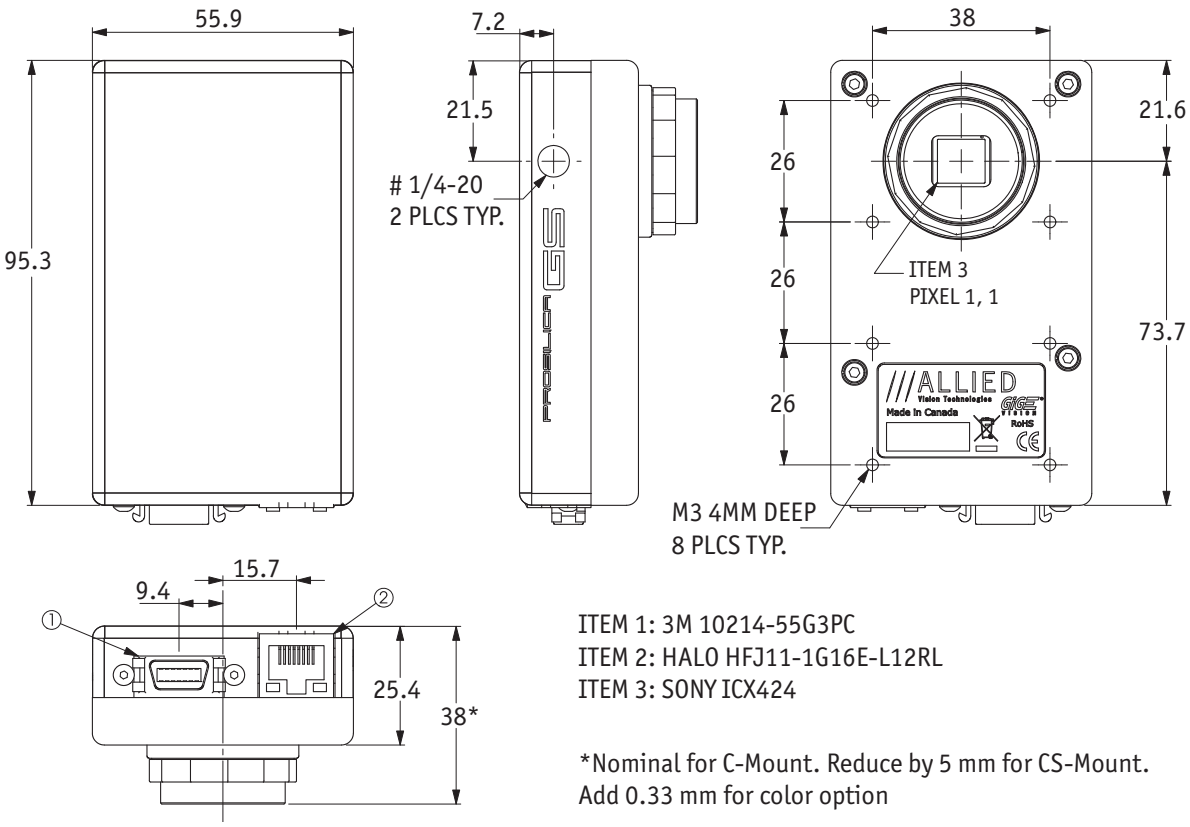
Sensor orientation	Model	Description	Example
Landscape	GS	Sensor mounted in landscape orientation	GS1380
Portrait	GS-P	Sensor mounted in portrait orientation	GS1380-P

Table 8: Prosilica GS sensor orientations

Note GS660/660C and GS2450/2450C do not support portrait sensor orientation.

Mechanical drawings

Landscape sensor

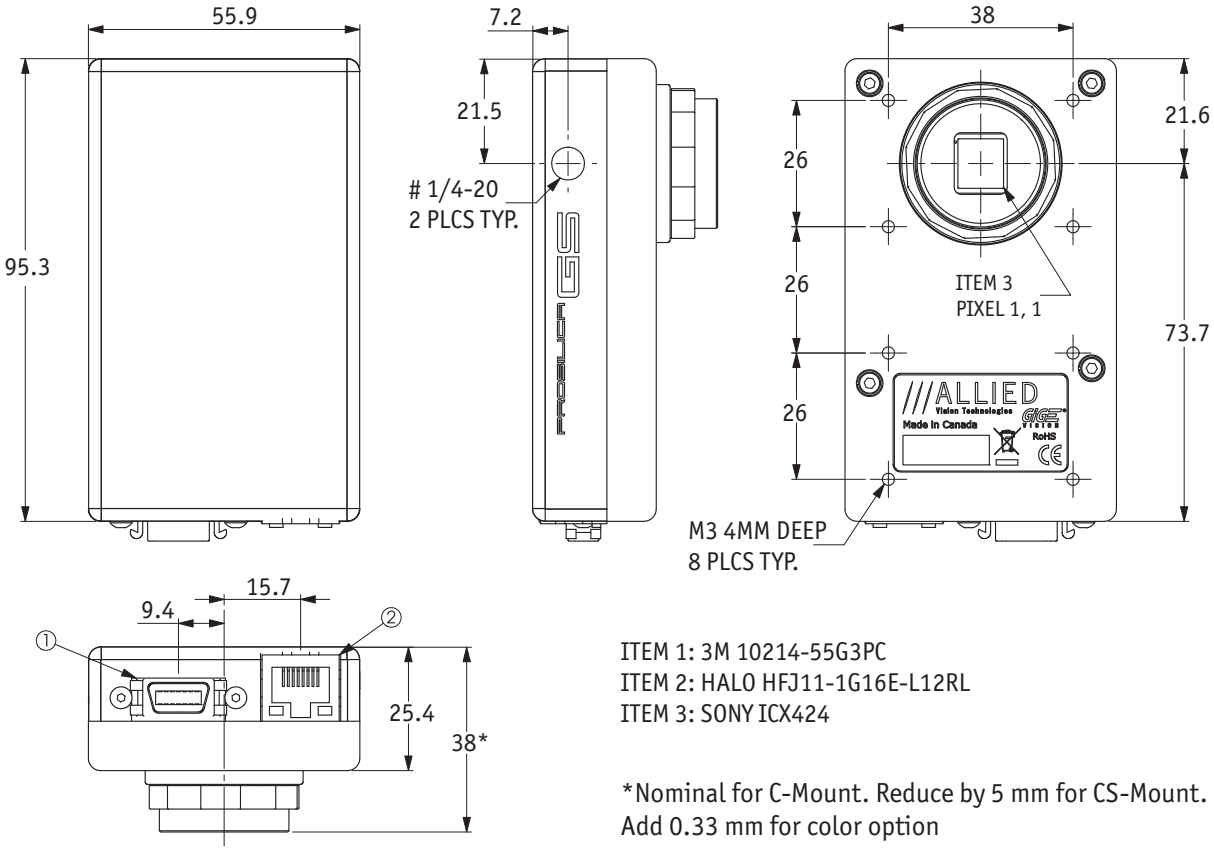


ITEM 1: 3M 10214-55G3PC
ITEM 2: HALO HFJ11-1G16E-L12RL
ITEM 3: SONY ICX424

*Nominal for C-Mount. Reduce by 5 mm for CS-Mount.
Add 0.33 mm for color option

Figure 10: Prosilica GS650/GS650C mechanical drawing

Portrait sensor



ITEM 1: 3M 10214-55G3PC
ITEM 2: HALO HFJ11-1G16E-L12RL
ITEM 3: SONY ICX424

*Nominal for C-Mount. Reduce by 5 mm for CS-Mount.
Add 0.33 mm for color option

Figure 11: Prosilica GS650-P/GS650C-P mechanical drawing

Optical flange focal distance

Optical flange focal distance is the optical distance from the mounting flange to the image sensor die (see figure 12). Optical flange focal distance can be calculated as:

$$\text{Optical flange focal distance} \approx \text{Flange focal distance} - \left(\frac{\text{IR cut filter thickness} + \text{Sensor window thickness}}{3}\right)$$

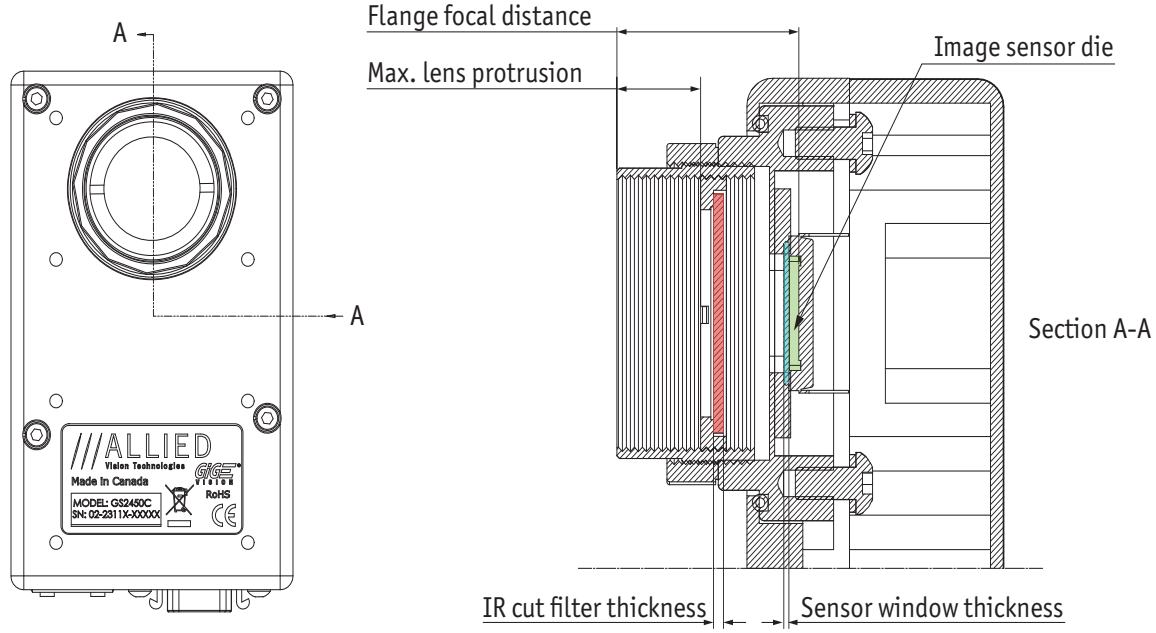


Figure 12: Cross section of typical Prosilica GS assembly with C-Mount

Camera	Sensor orientation	Lens protrusion [mm]	IR cut filter* [mm]	Sensor window [mm]	Nominal flange focal distance [mm]
GC650	Portrait	13.64	0.00	0.75	17.78
GS650	Landscape	13.64	0.00	0.75	17.78
GC650C	Landscape	8.95	1.00	0.75	18.11
GC650C	Portrait	9.27	1.00	0.75	18.11
GC660	Landscape	13.64	0.00	0.75	17.78
GC660C	Landscape	8.41	1.00	0.75	18.11
GC1380	Landscape	13.64	0.00	0.75	17.78
GC1380	Portrait	13.64	0.00	0.75	17.78
GC1380C	Landscape	9.00	1.00	0.75	18.11
GC1380C	Portrait	9.32	1.00	0.75	18.11
GC2450	Landscape	13.64	0.00	0.50	17.69
GC2450C	Landscape	8.29	1.00	0.50	18.03
* Only color camera models are equipped with IR cut filter.					

Table 9: Flange focal distance and maximum lens protrusion for Prosilica GS cameras with C-Mount

Adjustment of lens mount

www

Prosilica GS cameras can be equipped with an adjustable C-Mount or a CS-Mount depending on sensor size and camera order code. **See AVT Modular Concept** for more information:

http://www.alliedvisiontec.com/us/support/downloads/product-literature/avt-modular-concept.html

The C-Mount or CS-Mount is adjusted at the factory and should not require adjusting. If for some reason the lens mount requires adjustment, use the following method.

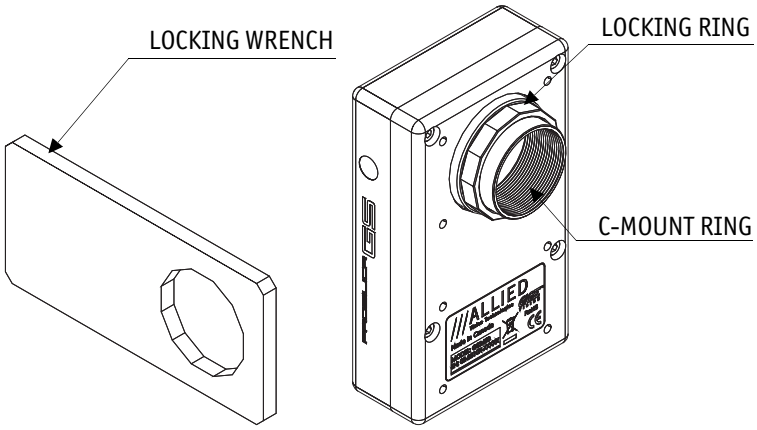


Figure 13: Prosilica GS camera front view

Loosen locking ring

Use an adjustable wrench to loosen the locking ring. Be careful not to scratch the camera. When the locking ring is loose, unthread the ring a few turns from the camera face.

Note

A wrench suitable for this procedure is available for purchase from AVT.
AVT P/N: 02-5003A

Image to infinity

Use a C-Mount compatible lens (CS-Mount compatible lens, if using CS ring) that allows an infinity focus. Set the lens to infinity and image a distant object—10 to 15 m should suffice. Make sure the lens is firmly threaded onto the C-Mount ring. Rotate the lens and C-Mount ring until the image is focused. Carefully tighten the locking ring and recheck focus.

Camera interfaces

This chapter provides information on Gigabit Ethernet port, inputs and outputs, and trigger features.

www

For more information on GigE accessories:
http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html

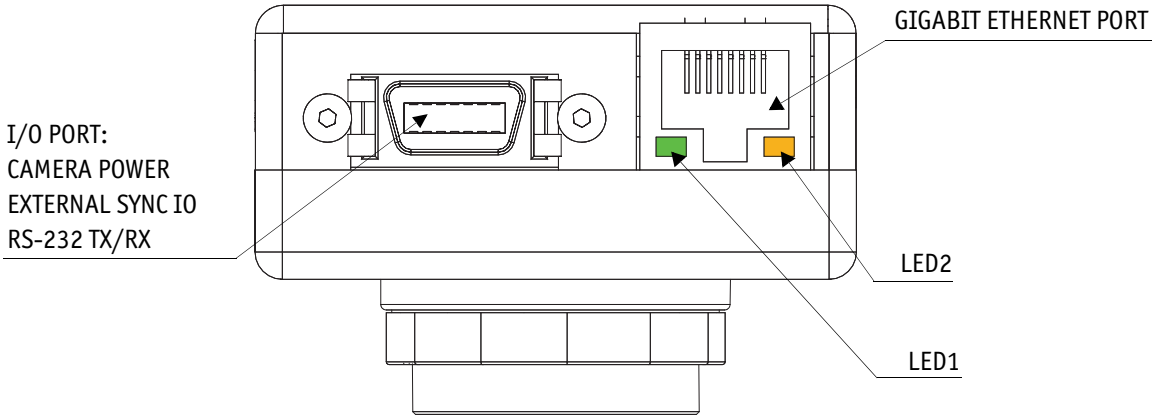


Figure 14: Prosilica GS connection ports

Status LEDs

The color of the LEDs have the following meaning:

	LED Color	Status
LED1	Flashing green	Camera is powered
	Solid green	Camera is booted, and link with the host is established
LED2	Flashing/solid orange	Ethernet activity

Table 10: Status of LEDs in Prosilica GS

Note

Once the camera is booted, LED1 will remain solid green as long as the camera is powered, even if connection with the host is lost.

Gigabit Ethernet port

The Gigabit Ethernet port conforms to the IEEE 802.3 1000BASE-T standard for Gigabit Ethernet over copper. We recommend using Category 6 or higher compatible cabling and connectors for best performance.

www

The **AVT GigE Installation Manual** offers detailed instructions for using Prosilica GS cameras.

http://www.alliedvisiontec.com/fileadmin/content/PDF/Products/Technical_Manual/GigE_Install_Manual/AVT_GigE_Installation_Manual.pdf

Note

See **Hardware Selection for AVT GigE Cameras** application note for a list of recommended Ethernet adapters:

http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/Hardware_Selection_for_AVT_GigE_Cameras.pdf

A standard Ethernet adapter is available for purchase from AVT:
AVT P/N: 02-3002A
Model: Intel Pro 1000/PT

Note

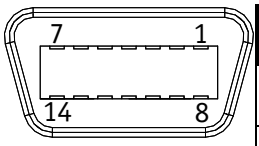
Cable lengths up to 100 m are supported.

The 8-pin RJ-45 jack has the pin assignment according to the Ethernet standard (IEEE 802.3 1000BASE-T).

Cables with screw-lock connectors are available for purchase from AVT:

http://www.alliedvisiontec.com/emea/products/accessories/gige-accessories.html

Camera I/O connector pin assignment



Pin	Signal	Direction	Level	Description
1	Camera Power	In	5–16* VDC	Power supply
2	Camera GND	In	GND for ext. power	Ground for camera power supply
3	In 1	In	U_{in}(high) = 5–24 V U_{in}(low) = 0–0.8 V	Input 1 opto-isolated (SyncIn1)
4	Isolated IO GND	In/Out	Common GND for In/Out	Isolated input and output signal ground
5	Out 1	Out	Open emitter max. 20 mA	Output 1 opto-isolated (SyncOut1)
6	Video Iris	Out	---	PWM signal for iris control
7	Reserved	---	---	---
8	Camera Power	In	5–16* VDC	Power supply
9	Camera GND	In	GND for ext. power	Ground for camera power supply
10	TxD RS-232	Out	RS-232	Terminal transmit data
11	RxD RS-232	In	RS-232	Terminal receive data
12	In 2	In	LVTTL max. 3.3 V	Input 2 non-isolated (SyncIn2)
13	Out 2	Out	LVTTL max. 3.3 V	Output 2 non-isolated (SyncOut2)
14	Signal GND	---	---	Ground for RS-232 and non-isolated outputs
*Some models offer 5–25 VDC. See Camera power section for details.				

Figure 15: Camera I/O connector pin assignment

The General Purpose I/O port uses a 3M 10214-55G3PC (or 3M 10214-6212PC) connector on the camera side. The mating cable connector is 3M 10114-3000PE or a connector with shielded housing 3M 10314-3210-00X (X indicates color preference).

Note

The cable side Hirose connector is available for purchase from AVT.
AVT P/N: 02-7003A

I/O definition

Camera power

The Prosilica GS camera family has recently been updated to offer an expanded input power voltage range. The camera serial number is used to differentiate between cameras that offer 5–16 VDC and those that offer 5–25 VDC.

Caution

SN: 02-22XX**A**, 5–16 V. 12 V nominal.

SN: 02-22XX**B**, 5–25 V. 12 V nominal.

Note

A 12 V power adapter with camera connector is available for purchase from AVT:

- AVT P/N: 02-8007A North America Supply.
- AVT P/N: 02-8008A Universal Supply.

Isolated IO ground

The **Isolated IO GND** connection provides the user ground reference and return path for **In 1**, and **Out 1**. It is recommended that the ground wiring be physically close to the **In/Out** wiring to prevent parasitic coupling. For example, a good cable design connects **In 1** to one conductor of a twisted pair, **Isolated IO GND** to the second conductor of the same twisted pair.

RxD RS-232 and TxD RS-232

These signals are RS-232 compatible. These signals allow communication from the host system via the Ethernet port to a peripheral device connected to the camera. These signals are not isolated; therefore, careful attention should be used when designing cabling in noisy environments.

www

For complete RS-232 description and usage, see:

http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/AppNote_-_RS-232_AVT_GigE.pdf

Input triggers

Input triggers allow the camera to be synchronized to an external event. The camera can be programmed to trigger on the rising edge, falling edge, both edges, or level of the signal. The camera can also be programmed to capture an image at some programmable delay time after the trigger event.

In 1 – opto-isolated

In 1 is optically isolated and can be used in electrically noisy environments to prevent false trigger events. Tie **Camera GND** to **Isolated IO GND** to complete the trigger circuit. Compare to the non-isolated trigger, **In 1** has a longer propagation time. It can be driven from **5 to 24 V** with a **minimum current source of 10 mA.** See Camera I/O opto-isolated user circuit example for more information.

In 2 – non-isolated

In 2 is non-isolated and can be used when a faster trigger is required and when environmental noise is inconsequential. The required signal is **low voltage TTL 3.3 V**. Tie **Signal GND** to **Camera GND** to complete the trigger circuit. See Camera I/O non-isolated user circuit example for more wiring information.

Caution **Do not exceed 5.5 V on signal inputs unless otherwise indicated.**

Output signals

Output signals can be assigned to a variety of internal camera signals via software. They can be configured to active high or active low. The internal camera signals are listed as follows:

Exposing	Corresponds to when camera is integrating light
Trigger Ready	Indicates when the camera is ready to accept a trigger signal
Trigger Input	A relay of the trigger input signal used to “daisy chain” the trigger signal for multiple cameras
Readout	Valid when camera is reading out data
Imaging	Valid when camera is exposing or reading out
Strobe	Programmable pulse based on one of the above events
GPO	User programmable binary output

Out 1 – opto-isolated

Out 1 is optically isolated and should be used in noisy environments. Out 1 requires a pull up resistor of greater than 1 KΩ to the user’s 5 V logic supply. Tie **Camera GND** to **Isolated IO GND** to complete the external circuit. See Camera I/O opto-isolated user circuit example for more information.

Out 2– non-isolated

Out 2 signal is not electrically isolated and can be used when environmental electrical noise is inconsequential and faster trigger response is required. Use **Signal GND** to complete the external circuit. The output signal is a **low voltage TTL, maximum 3.3 V**. **Not suitable for driving loads in excess of 24 mA**. See Camera I/O non-isolated user circuit example for more wiring information.

Signal ground

Signal Ground must be connected to the user's external circuit ground if **In 2** or **Out 2** is to be used, or if the RS-232 port is to be used. Note that **Signal Ground** is common with **Camera GND**; however, it is good practice to provide a separate ground connection for power and signal.

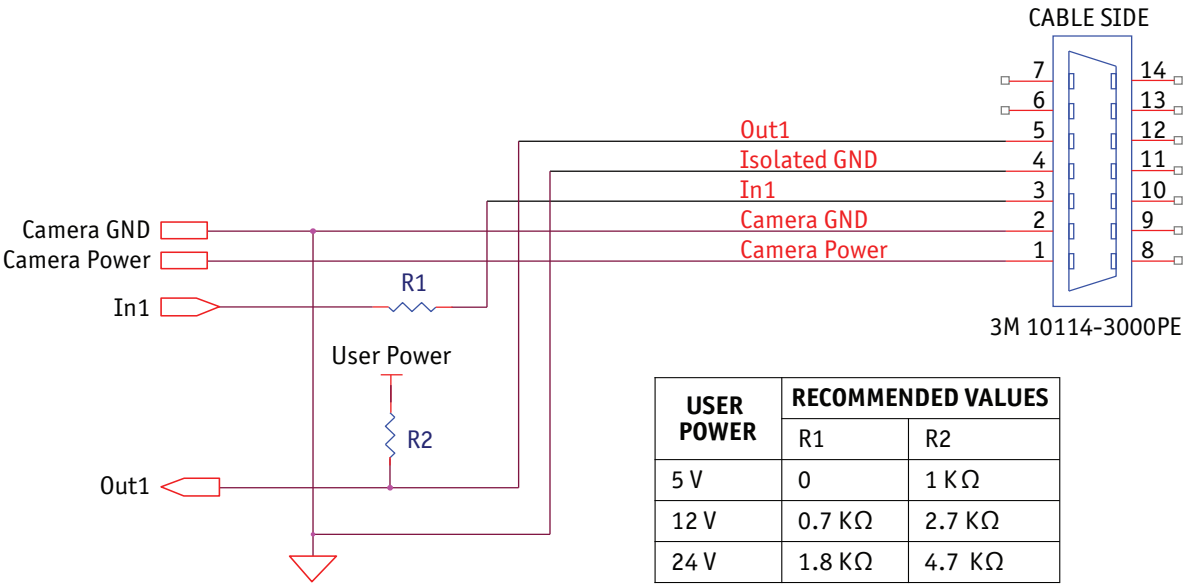
Video iris

This signal can be used to drive the video input of a video iris lens. See Video iris user circuit example section for wiring information.

Reserved

These signals are reserved for future use and should be left disconnected.

Camera I/O opto-isolated user circuit example



USER POWER	RECOMMENDED VALUES	
	R1	R2
5 V	0	1 KΩ
12 V	0.7 KΩ	2.7 KΩ
24 V	1.8 KΩ	4.7 KΩ

Figure 16: Prosilica GS isolated trigger user circuit

*Cameras with SN: 02-XXXXX-**0**XXXX, R1 necessary for input greater than 5 V, see table above. Cameras with SN: 02-XXXXX-**1**XXXX, no R1 is necessary, 5–24 V.

Caution

Input: Incoming trigger must be able to source 10 mA.

Output: User power, with pull-up resistor R2 is required.

Isolated output is connected to the open collector of Fairchild MOCD207. The corresponding transistor emitter is connected to isolated ground. See the Fairchild MOCD207 datasheet for more detailed information.

Camera I/O non-isolated user circuit example

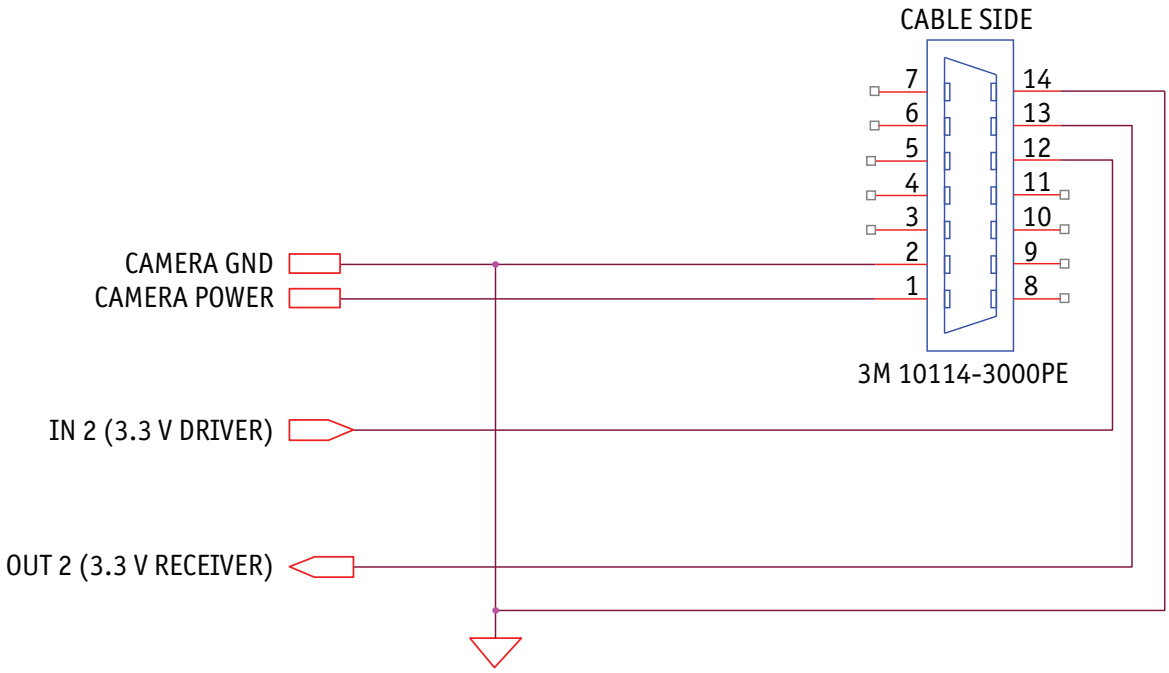


Figure 17: Prosilica GS non-isolated trigger user circuit

Caution

Input: Incoming trigger must be able to source 10 µA, at 3.3 V. Input trigger voltage greater than 5.5 V will damage the camera.

Output: The maximum sync output current is 24 mA, at 3.3 V.

The non-isolated trigger circuit is connected to a Texas Instruments SN74LVC2G241 buffer/driver inside the camera. See the Texas Instruments SN74LVC2G241 for more detailed information.

Video iris user circuit example

Prosilica GS series cameras provide built-in auto iris controls for controlling video-type auto-iris lenses. These lenses are available from many popular security lens companies including Pentax, Fujinon, Tamron, Schneider and others.

Remote iris lens control allows the camera to be more adaptable to changing light conditions. It allows the user to manually control the exposure and gain values and rely solely on the auto iris for adjustment to ambient lighting.

Caution

The following schematic uses CAMERA POWER to power the video iris lens, and assumes CAMERA POWER = 12 V. Most video iris lenses operate at a 8–16 V input voltage. **Therefore, this circuit is not appropriate if using a 24 V camera power supply. Doing so may irreparably damage your lens**. Please consult your video iris lens specifications for the appropriate drive voltage.

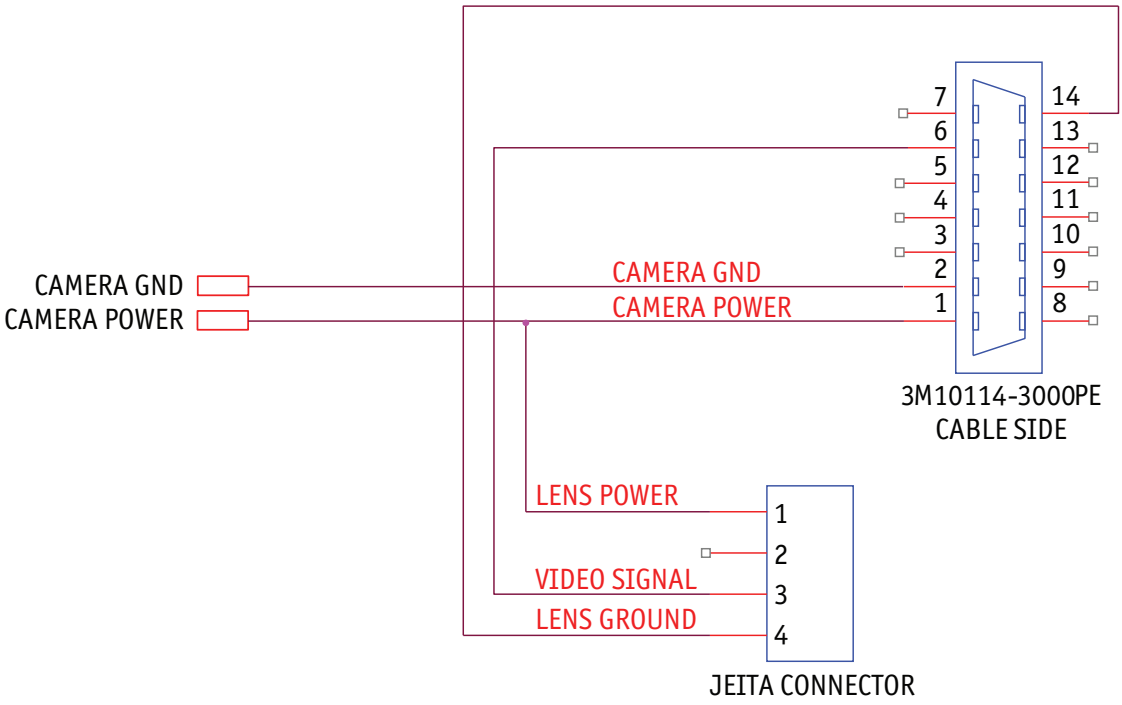


Figure 18: Prosilica GS video iris user circuit diagram

Trigger timing diagram

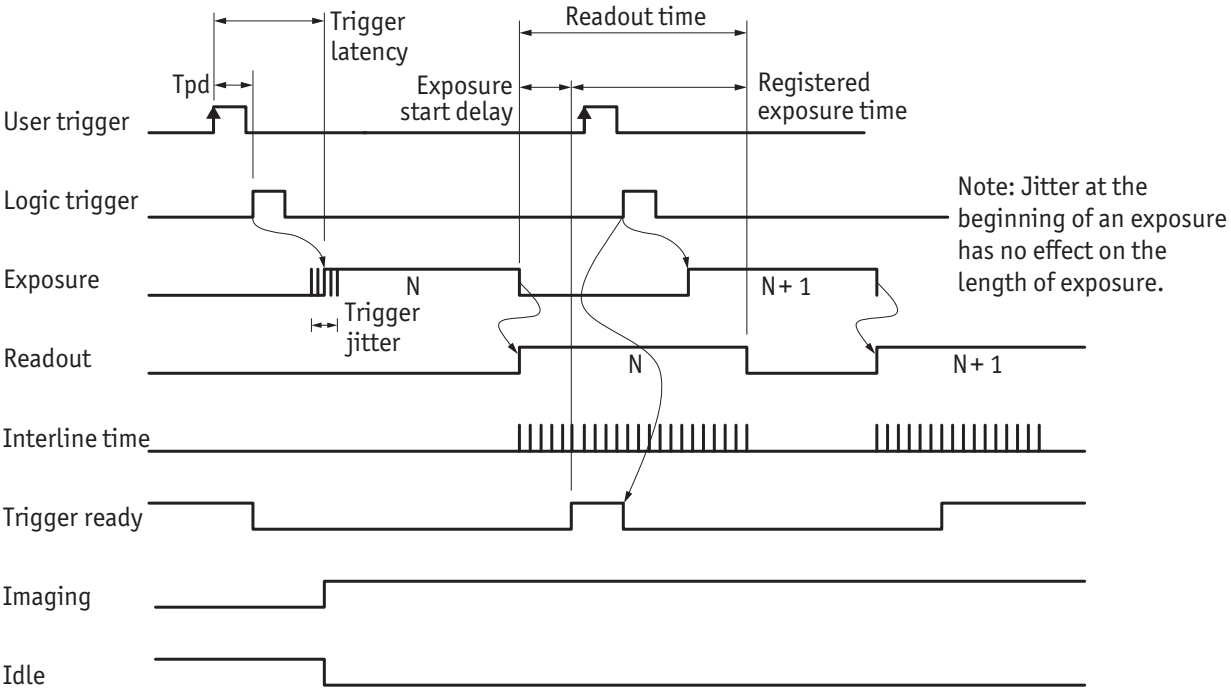


Figure 19: Prosilica GS internal signal timing waveforms

Notes on triggering

Term	Definition
User trigger	Trigger signal applied by the user (hardware trigger, software trigger)
Logic trigger	Trigger signal seen by the camera internal logic (not visible to the user)
Tpd	Propagation delay between the user trigger and the logic trigger
Exposure	High when the camera image sensor is integrating light
Readout	High when the camera image sensor is reading out data
Trigger Latency	Time delay between the user trigger and the start of exposure
Trigger jitter	Error in the trigger latency time

Table 11: Explanation of signals in timing diagram

Term	Definition
Trigger ready	Indicates to the user that the camera will accept the next trigger
Registered exposure time	Exposure time value currently stored in the camera memory
Exposure start delay	Registered exposure time subtracted from the readout time and indicates when the next exposure cycle can begin such that the exposure will end after the current readout
Interline time	Time between sensor row readout cycles
Imaging	High when the camera image sensor is either exposing and/or reading out data
Idle	High if the camera image sensor is not exposing and/or reading out data

Table 11: Explanation of signals in timing diagram

Trigger rules

Note

The **user trigger pulse width** should be at least three times the width of the trigger latency as indicated in Chapter Specifications on page 12.

- The **end of exposure** will always trigger the next readout.
- The **end of exposure** must always end after the current readout.
- The **start of exposure** must always correspond with the interline time if readout is true.
- **Exposure start delay** equals the readout time minus the registered exposure time.

Triggering during the idle state

For applications requiring the shortest possible *Trigger Latency* and the smallest possible *Trigger Jitter* the *User Trigger* signal should be applied when *Imaging* is false and *Idle* is true. In this case, *Trigger Latency* and *Trigger Jitter* are as indicated in the camera specifications.

Triggering during the readout state

For applications requiring the fastest triggering cycle time whereby the camera image sensor is exposing and reading out simultaneously, apply the *User Trigger* signal as soon as a valid *Trigger Ready* is detected. In this case, *Trigger Latency* and *Trigger Jitter* can be up to 1 row time since *Exposure* must always begin on an *Interline* boundary.

Firmware update

Firmware updates are carried out via the GigE connection. AVT provides an application for all Prosilica GS cameras that loads firmware to the camera using a simple interface. New feature introductions and product improvements motivate new firmware releases. All users are encouraged to use the newest firmware available and complete the firmware update if necessary.

www

Download the latest GigE firmware loader from the AVT website:
http://www.alliedvisiontec.com/us/support/downloads/firmware.html

www

For more information on GigE firmware update:
http://www.alliedvisiontec.com/fileadmin/content/PDF/Support/Application_Notes/AppNote_-_GigE_Firmware_Update.pdf

Resolution and ROI frame rates

This section charts the resulting frame rate from changing sensor region of interest (ROI), from full image to a single line.

Note

- Frame rate data was generated using **StreamBytesPerSecond = 124 MB/s** and an 8 bit pixel format such as Mono8 or BayerRG8. Frame rates may be lower if using network hardware incapable of 124 MB/s.
- The camera frame rate can be increased by reducing the camera's Height attribute, resulting in a decreased region of interest (ROI) or “window”.
- The camera frame rate can also be increased by increasing the camera's BinningY attribute, resulting in a vertically scaled image (less overall height with same field of view).
- There is no frame rate increase with reduced width.

Prosilica GS650

$$\text{Frame rate} = \frac{1}{14.39\ \mu s \times \text{Height} + 1114.28\ \mu s}$$

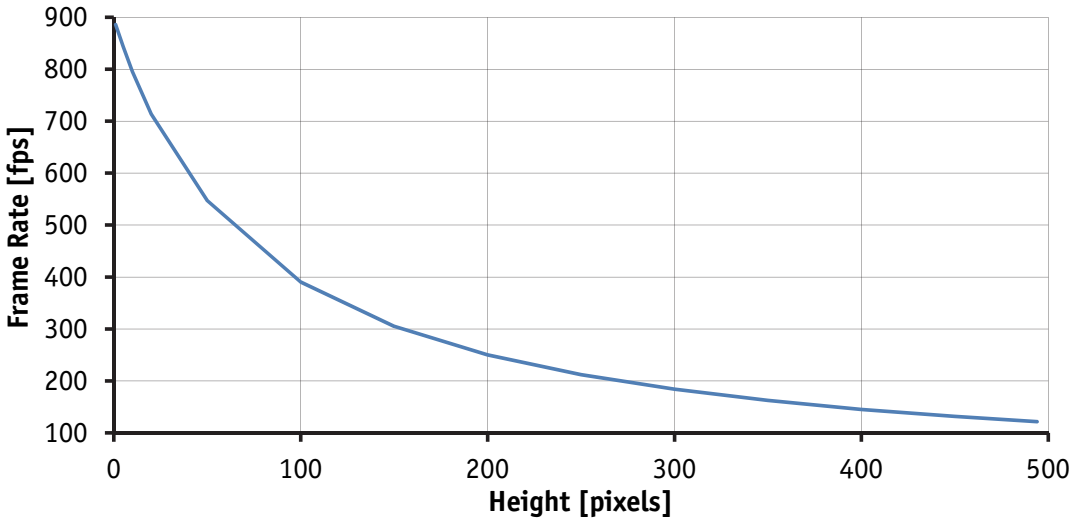


Figure 20: Frame rate vs. height for Prosilica GS650

Prosilica GS660

$$\text{Frame rate} = \frac{1}{13.26\ \mu s \times \text{Height} + 1844.78\ \mu s}$$

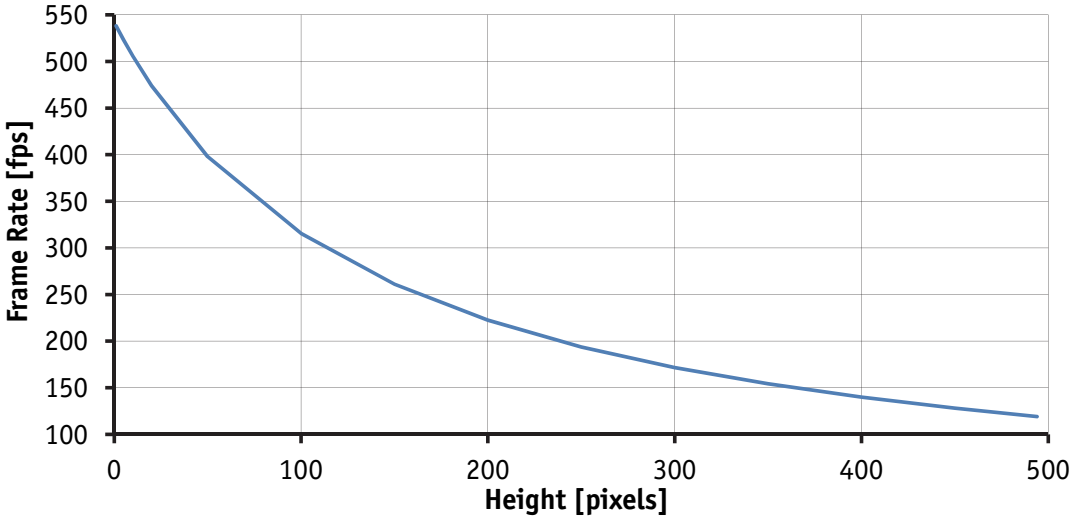


Figure 21: Frame rate vs. height for Prosilica GS660

Prosilica GS1380

$$\text{Frame rate} = \frac{1}{27.79\ \mu s \times \text{Height} + 4881.40\ \mu s}$$

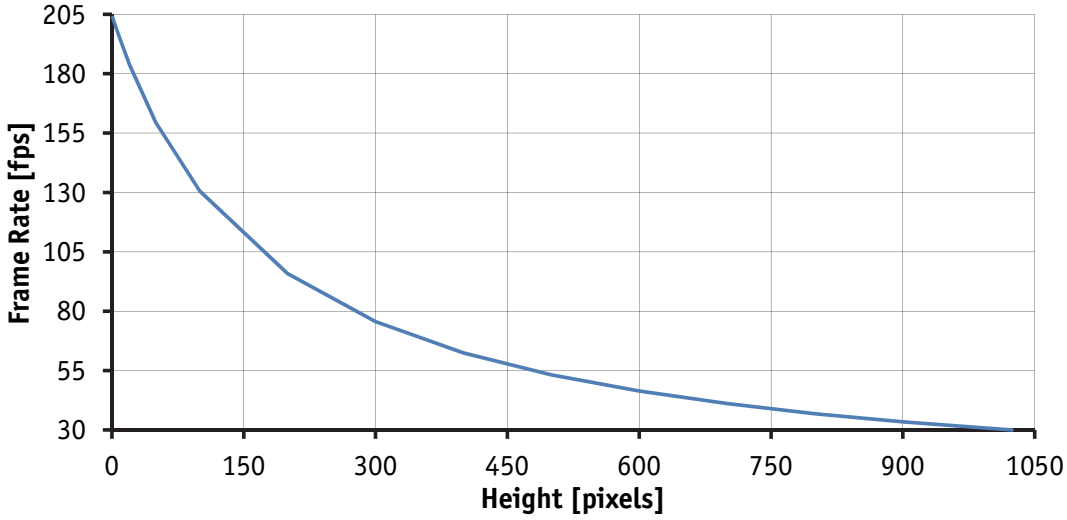


Figure 22: Frame rate vs. height for Prosilica GS1380

Prosilica GS2450

$$\text{Frame rate} = \frac{1}{26.63\ \mu s \times \text{Height} + 12079.91\ \mu s}$$

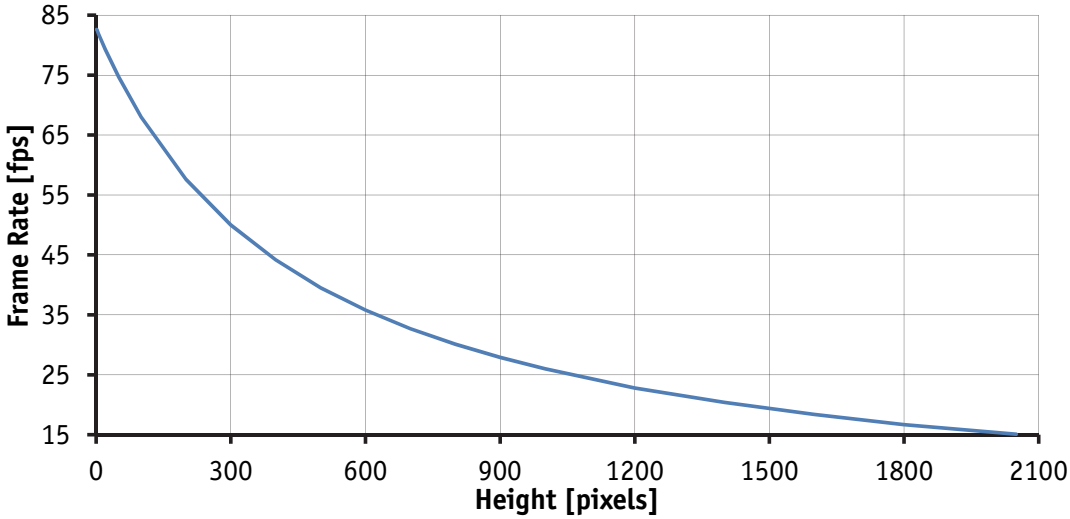


Figure 23: Frame rate vs. height for Prosilica GS2450

Prosilica GS model comparison

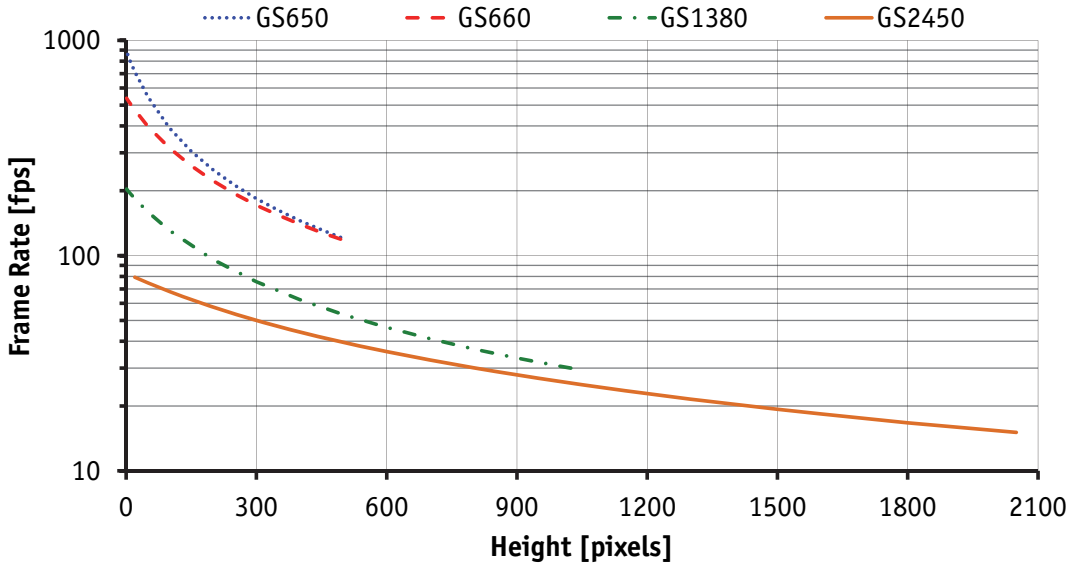


Figure 24: Maximum frame rate versus region height for all Prosilica GS cameras

Description of the data path

The following diagrams illustrate the data flow and the bit resolution of image data. The individual blocks are described in more detail in the **AVT GigE Camera and Driver Features** document.

Prosilica GS: monochrome cameras

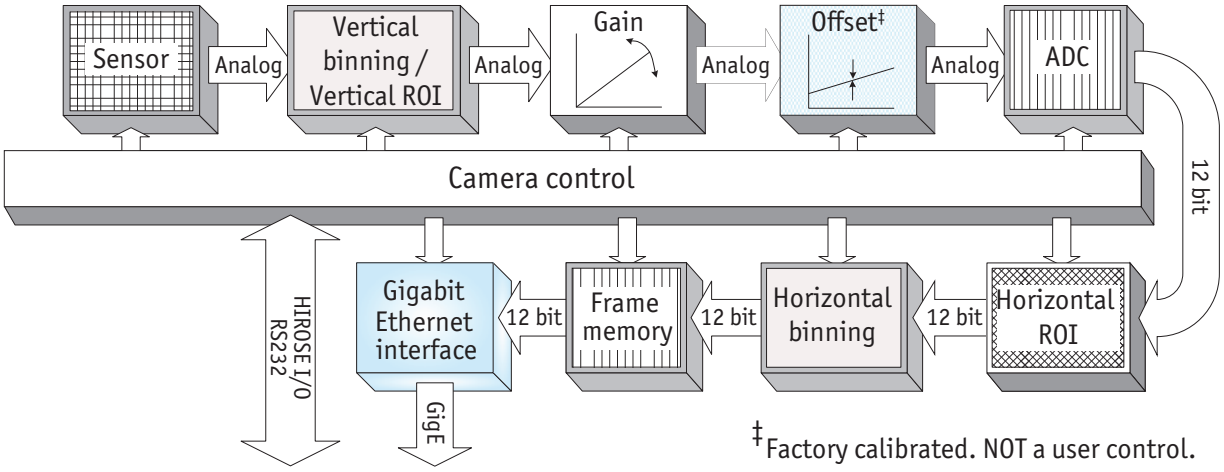


Figure 25: Block diagram of Prosilica GS monochrome cameras

Prosilica GS: color cameras

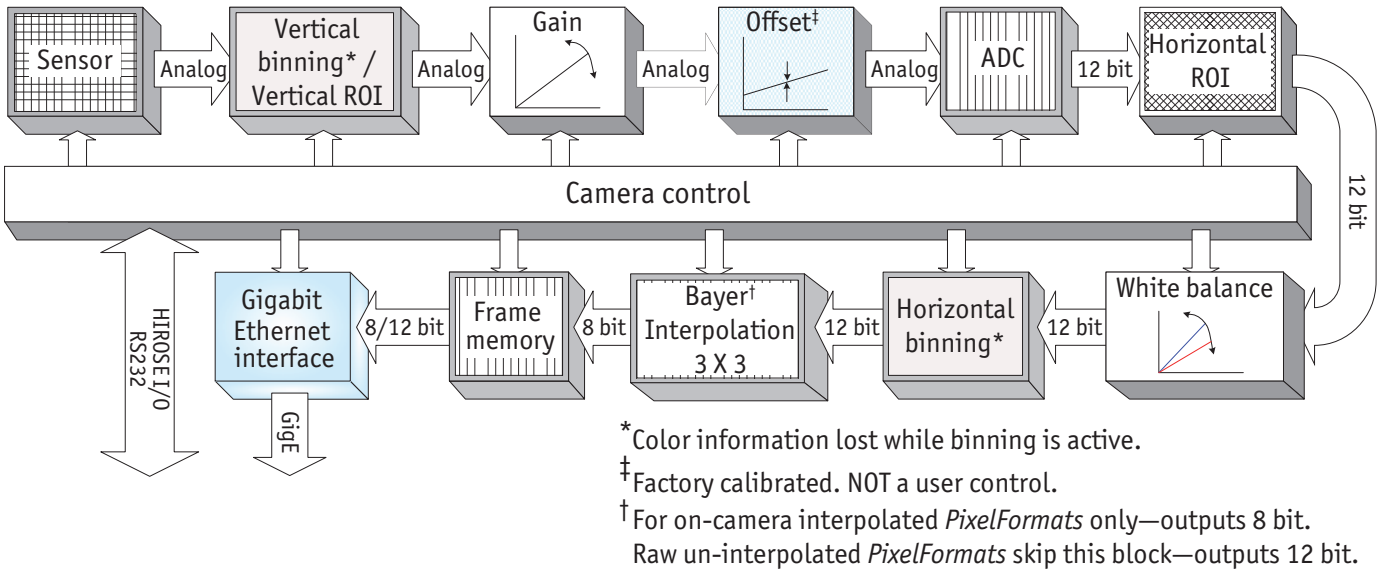


Figure 26: Block diagram of Prosilica GS color cameras

Additional references

Prosilica GS webpage

http://www.alliedvisiontec.com/us/products/cameras/gigabit-ethernet/prosilica-GS.html

Prosilica GS Documentation

http://www.alliedvisiontec.com/us/support/downloads/product-literature/prosilica-GS.html

AVT VIMBA SDK

http://www.alliedvisiontec.com/us/products/software/vimba-sdk.html

AVT GigE PvAPI SDK

http://www.alliedvisiontec.com/us/products/legacy.html

AVT Knowledge Base

http://www.alliedvisiontec.com/us/support/knowledge-base.html

AVT Case Studies

http://www.alliedvisiontec.com/us/products/applications/industrial-inspection.html

Prosilica GS Firmware

http://www.alliedvisiontec.com/us/support/downloads/firmware.html

Index

B

Block diagram
- Prosilica GS color cameras 42
- Prosilica GS monochrome cameras 42

C

Camera dimensions 22
Camera GND 29, 31, 32
Camera interfaces 27
Camera power 29, 30
CE 11
Cleaning optics 9
Copyright 2

D

Data path 42
declaration of conformity 11
Document history 6

E

Environmental specifications 8
exposing (trigger) 37
exposure (definition) 36
exposure cycle (trigger) 37
exposure start delay 37

F

FCC Class A 11
Firmware update 38

G

Gigabit Ethernet port 28
GND for ext. power 29

I

idle (signal) 37
imaging (signal) 37
Input triggers 30
- In 1 ..... 29, 30, 31
- In 2 ..... 29, 31, 32

integrating light (trigger) 36
interline time 37
IR filter 9, 21
IRC30 21
Isolated IO GND 29, 30, 31

L

Landscape 22, 23
Legal notice 2
logic trigger 36

M

Mechanical drawings 23
- Landscape sensor 23
- Portrait sensor 24

Multicast 20

O

Optical flange focal distance 25
Output signals 31
- Out 1 ..... 29, 30, 31
- Out 2 ..... 29, 31

P

Portrait 22, 24
Precautions 8
propagation delay (trigger) 36

R

readout (definition) 36
Region of interest 20, 39
registered exposure time 37
Resolution and ROI frame rates
- Model comparison 41
- Prosilica GS1380 40
- Prosilica GS2450 41
- Prosilica GS650 39
- Prosilica GS660 40

RoHS (2011/65/EU) 11
RS232 29
RxD RS-232 ..... 29, 30

S

sensor row readout cycles 37
Signal GND 29, 31
Spectral sensitivity
Prosilica GS1380 monochrome 17
Prosilica GS1380C color 17
Prosilica GS2450 monochrome 19
Prosilica GS2450C color 19
Prosilica GS650 monochrome 13
Prosilica GS650C color 13
Prosilica GS660 monochrome 15
Prosilica GS660C color 15
Status LEDs 27
Storage temperature 12, 14, 16, 18
StreamBytesPerSecond 39
Styles 7
Symbols 7

T

time delay (trigger) 36
Tpd (definition) 36
Trademarks 2
Trigger jitter 36, 37
Trigger latency 36, 37
trigger latency time 36
trigger ready 37
trigger rules 37
Trigger timing diagram 36
TxD RS-232 ..... 29, 30

U

user trigger 36

V

Video Iris 29, 32, 35

W

Warranty 2, 8